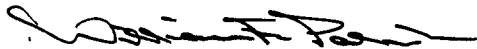


OUTLET PRESCRIBED FIRE PROJECT
GRAND CANYON NATIONAL PARK
INVESTIGATIVE TEAM REPORT

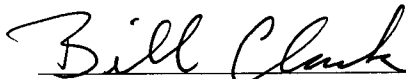
MAY 22, 2000



William F. Paleck, Superintendent, North Cascades National Park, Co-chair



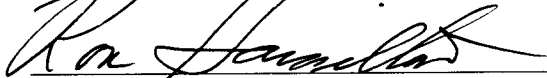
Rodd Richardson, Forest Supervisor, Bitterroot National Forest, Co-chair



Bill Clark, Idaho State Fire Management Officer, Bureau of Land Management



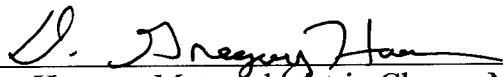
Bill Wallis, Colorado State Fire Management Officer, Bureau of Land Management



Ron Hamilton, Fire Weather Meteorologist, United States Forest Service



Stephen G. Jakala, Fire Management Officer, Voyageurs National Park



Greg Harmon, Meteorologist-in-Charge, National Weather Service,
Sioux Falls, South Dakota

Background

Grand Canyon National Park has had a successful prescribed fire program for many years. The objectives of the program are to return fire as a landscape scale ecological process, improve habitat for a variety of plant and animal species dependent on a fire adapted ecosystem, and to reduce hazardous accumulations of fuel.

As with many areas of the West, suppression of fire on the North Rim of the Grand Canyon over the last century has resulted in an accumulation of litter (fallen trees, branches, and shed leaves and needles), as well as an invasion of spruce/fir thickets providing fuel ladders that can result in catastrophic crown fires. This unnatural and hazardous fuel load situation was recognized as early as 1981 (Appendix A). In 1997 a National Park Service/Department of the Interior review team recognized the situation and recommended the development of a landscape-level prescribed fire program for the management of the North Rim forests (Appendix B).

The current fire program operates under the Wildland Fire Management Plan first approved in 1992 and updated in 1993, 1994, and 1995. An Amendment to the Fire Management Plan was approved in 1998 to incorporate principles, policies, and recommendations of the *Federal Wildland Fire Management Policy and Program Review*.

Introduction

The *Outlet Prescribed Fire Project Plan* was approved in January 1999. It covers a 13,824 acre unit on the North Rim of the Grand Canyon lying between the Bright Angel Creek and Dragon Creek drainages (Appendix C).

The Widforss burn is a 1030 acre sub-unit of the Outlet Prescribed Fire Project area located west of the Bright Angel Point developed area. Elevation ranges from 8080 to 8400 feet. Vegetation varies from ponderosa pine forests to dense mixed conifer and aspen. Boundaries to the unit are the Widforss Trail along the canyon rim on the south and a series of secondary roads on other sides forming a roughly triangular-shaped area (map Appendix D). Management of the Widforss sub-unit began as early as December 1995 with a small section of blackline burned under a previous burn plan. Additional blackline was burned in 1997, 1998, and 1999.

The Tiyo sub-unit is located further to the west, south of a large meadow known as The Basin. It is an irregularly-shaped, 940 acre area. The northwest corner lies on the canyon rim above Dragon Creek (map Appendix E).

Weather conditions in the Outlet Prescribed Fire Project area this year were similar to those which existed throughout most of the southwestern United States, relatively dry and mild. The area was just coming out of the second winter season with below normal precipitation. This season's precipitation was less than fifty percent of normal. Long-term drought indicators, such as the Palmer Drought Index, showed conditions to be in the moderate to severe drought range (Appendix F). On April 15 snow cover on the Widforss sub-unit was estimated at 20-30 percent. Fire staff decided to take advantage of this situation by conducting an early spring prescribed burn of the Widforss and Tiyo sub-units.

On April 27, 2000 the planned blackline on the south edge of the Widforss was hand ignited in preparation to burning the entire sub-unit. The Tiyo burn was aerial ignited the same day. A malfunction of the ignition device resulted in an incomplete or "dirty" burn. The burns proceeded for several days. On the evening of May 9, due to the cumulative effect of several factors, the Acting Superintendent decided to convert the Outlet prescribed fires to wildland fires. The reasons articulated for making this decision were:

- difficulty in securing resources for the prescribed burns, and
- forecasted high winds for the next day.

Both burns officially became wildland fires at 0900 May 10.

A previously undetected spot fire from the Widforss sub-unit escaped containment on the afternoon of May 10 and, driven by strong winds, developed into the 13,000 acre Outlet Fire. The Tiyo sub-unit remained within the boundaries of its prescribed burn plan.

Grand Canyon National Park Superintendent Robert Arnberger requested an investigation of the events leading up to the declaration of a wildland fire on May 10. An interagency team was selected by the National Park Service leadership at the National Interagency Fire Center in Boise, Idaho. This eight person team met in Grand Canyon National Park May 18-22 to investigate the circumstances leading to the wildland fire declaration.

Investigative Team

The investigative team consisted of:

Co-chairs:

William F. Paleck
Superintendent
North Cascades National Park, National Park Service

Rodd Richardson
Forest Supervisor
Bitterroot National Forest, United States Forest Service

Fire Behavior

Bill Clark
Idaho State Fire Management Officer,
Bureau of Land Management

Prescribed Fire Operations

Bill Wallis
Colorado State Fire Management Officer
Bureau of Land Management

Fire Weather Meteorologist
Ron Hamilton
U.S. Forest Service South Operations, USDA
Riverside, California

NPS Regional Liaison
Stephen G. Jakala
Fire Management Officer
Voyageurs National Park, National Park Service

National Weather Service
Greg Harmon
Meteorologist-in-Charge
Sioux Falls, South Dakota

Writer-Editor
Tom Pittenger
Natural Resources Education Specialist
Grand Canyon National Park, National Park Service

The Superintendent instructed the Team to pursue three objectives (Appendix G):

1. If the Prescribed Fire Plan was adequate given the complexity, objectives and environmental conditions, and if it complied with NPS guidance set forth in Director's Order 18 and Reference Manual 18.
2. If the prescription, actions and procedures set forth in the *Outlet Prescribed Fire Project Plan* were followed.
3. If prescribed fire training and experience of personnel involved were commensurate with agency qualification standards.

The Team spent four days in Grand Canyon National Park reviewing documents, conducting interviews, and preparing this report. During the investigation over 40 people on both the North and South Rims of the park and elsewhere were interviewed to gather information on the events leading up to the change to wildland fire status effective May 10. The Team also reviewed numerous plans and voluminous amounts of background material provided by the Grand Canyon fire management staff.

The team identified, investigated and answered four specific questions:

Did the Prescribed Fire Plan comply with NPS guidance set forth in Director's Order 18 and Reference Manual 18?

The *Outlet Prescribed Fire Project Plan* with its supplementing sub-unit plans fully complied with *Director's Order 18*. In making this determination the Team paid particular attention to

Sections 5.1 (Safety and Health), 5.6 (Prescribed Fire Operations), 5.7 (Prescribed Burn Plans), 5.8 (Prescribed Fire Monitoring), and 5.9 (Fuels Management).

In all respects the *Outlet Prescribed Fire Project Plan* with its supplementing sub-unit plans contains all the elements required by *Reference Manual 18*, except one. These plans do not include a specific section addressing *Test Fires* as required by Section B.5 of *Reference Manual 18*. It is important to note that despite this omission the Team found evidence that three test burns were conducted at appropriate times prior to ignitions. In addition, several of the staff interviewed stated that a pre-ignition test burn is standard operating protocol for all prescribed fires in the park.

Was the plan adequate given the complexity, objectives, and environmental conditions?

The Team finds that the *Outlet Prescribed Fire Project Plan* and the tiered implementation plans for the Widforss and Tiyo sub-units were not entirely adequate given the complexity, objectives, and environmental conditions.

While the Team found many areas of the prescribed fire plan to be adequate, the following paragraphs discuss areas of concern within the plan.

- The Risk Assessment Summary on pages 4-5 of the *Outlet Prescribed Fire Project Plan* is not adequate. Each risk analysis should contain an identification of the consequences of failure, a determination of the probability of success, and mitigation factors, including cost of mitigation. Values at risk are clearly identified. The discussion of the probabilities of success in the plan is less than complete. The Team believes this assessment does not fully assist the line officer in appreciating the probability of success or failure regarding both maintaining control and achieving resource objectives. The assessment should weigh risks associated with achieving resource objectives where they conflict with control objectives.
- Pre-burn Considerations on- and off-site are listed in general terms on pages 18-20. These considerations are important and are the same ones found in all the Grand Canyon National Park burn plans reviewed. The Team finds that these preparations are not sufficiently detailed for a prescribed burn of this complexity. Each burn sub-unit in the Outlet Prescribed Fire Project should have details as defined in *Reference Manual 18* B.5, Prescribed Fire Implementation Actions, specifically tailored to the prescribed burn sub-unit being undertaken.
- Burn Plan Prescription Parameters are too broad, intending to cover all possible geographic areas and fuel types on the entire Outlet Prescribed Fire Project area. Most of the prescriptive elements found on page 21, including temperatures, wind, and relative humidities, give such a broad range they become almost meaningless. The Team believes these ranges are an attempt to address a broad spectrum of fuel types and conditions including the difference between spring and fall burn windows.

The most important parameters in the prescription are flame length, rate of spread, and spotting distance, since they link directly to the resource and control objectives. The Team

questions whether prescribed intensities and flame lengths (both upper and lower) given in the full "Range" prescription can always meet resource objectives. The Team also questions if the high-end flame lengths can meet control objectives in all locations on the Outlet Prescribed Fire Project area.

When spotting distances are used as prescription parameters, they should be used in combination with a probability of ignition (PI) in non-target fuels. There also should be an explanation about when spotting distances should be calculated. In some cases spotting into the burn unit may not need monitoring.

- The *Outlet Prescribed Fire Project Plan* requires minimum holding and escape resources of a helicopter with bucket and a Type 5 engine within a two hour response time. Otherwise, there are no specific minimum Holding and Escape resource requirements that are tied to actual or potential fire behavior. In landscape-level prescribed burns there needs to be documented "triggers" which guide the burn boss in building or "ramping up" holding and escape forces. Likewise, these plans treat holding and escape forces needs identically in spring and fall burn windows.
- The issue of adequacy of test burn documentation is covered under the first question.
- With respect to burn organization, the Team found three charts. Each was slightly different. While the Team found each position was filled (sometimes with collateral duties), roles were not well documented and communicated.

The Team also is unclear about the required minimum number of personnel on each burn sub-unit and their minimum required qualifications. Though the Outlet Prescribed Fire Project is rated as complex, the Widforss sub-unit was treated as a moderate complexity. The Team found no clear documentation of the complexity analysis that guided this approach.

Were the prescription, actions and procedures set forth in the *Outlet Prescribed Fire Project Plan* followed?

The observed and documented fire behavior was within prescription parameters set forth in the *Outlet Prescribed Fire Project Plan* during the course of the prescribed fire operations, from ignition on April 27 through 0900 May 10, 2000 (Appendices H, I).

The Team found no clear violations of actions or procedures identified in the plan. However, the Team could not find any documentation or evidence of the following:

- Signed Go-No Go Checklists covering the period April 28 through May 5.
- Written instructions for ground firing sequences, either in the plan or in daily action plans.
- Aerial Ignition Operations Hazards Analysis and Aviation Operations plans with a firing map and landing locations, although thorough oral briefings were given.

- Locations for road signs covering closure and notification to the public.

In the opinion of the Team none of these apparent omissions contributed to the conversion to a wildland fire.

Was the prescribed fire training and experience of personnel involved commensurate with agency qualification standards?

All personnel involved in implementing the Outlet Prescribed Fire meet existing National Wildfire Coordinating Group standards. Grand Canyon National Park supervisory fire personnel involved in the Outlet Prescribed Fire are highly experienced in prescribed burning as well as fire suppression operations.

Best Practices

In the course of our investigation the Team identified several elements of the Grand Canyon Prescribed Fire Program as practiced on the Outlet Prescribed Fire Project that merit listing in this report.

- Notifications to park staff, cooperators, the general public, and other interested parties before and during the prescribed burn were excellent. The protocols established for this practice are comprehensive and were fully executed.
- Daily briefings and debriefings of all personnel involved on site in the prescribed burn were frequently identified as a positive hallmark of the burn operations. Several of those who were interviewed commented on the quality, content and openness of these briefings.
- The relationship between staff at the National Weather Service in Flagstaff and the prescribed burning staff at Grand Canyon is a collaborative partnership. The Team believes that it sets a standard for emulation elsewhere.
- Fire staff at Grand Canyon are clearly enthused by the support and encouragement they receive from Superintendent Robert Arnberger and his management team. Their passion to develop and conduct a state of the art comprehensive fire management program of the highest professional order is impressive.

Conclusions

The Investigative Team is unanimously impressed with the overall competence, professionalism and accomplishments of the Grand Canyon Prescribed Fire Program. We have identified specific areas for improvement in the level of documentation provided in future burn plans, as well as documentation of actions taken during the conduct of prescribed burns. However, the program itself is fundamentally sound.

Since at least 1981 forest and fire ecologists as well as fire management specialists have documented the severely hazardous accumulations of forest fuels on the North Rim of the Grand Canyon. It is clear that the park took the recommendations of the 1997 review performed by fire program specialists from the National Interagency Fire Center and the Department of the Interior as a charge to become more aggressive in the re-introduction of fire to the North Rim on a landscape level. While maintaining a priority on public and fire staff safety as well as tying prescribed burning directly to desired resource objectives they revised their burn plans to put more latitude in the hands of their highly qualified command staff to take greater advantage of prescription “windows” as they arose. During 1998 and 1999 they prescribe burned a total of over 16,000 acres. That level of accomplishment, performed without incident, is notable.

Nevertheless, the Outlet Prescribed Fire was converted to a wildland fire that subsequently covered over 13,000 acres and cost millions of dollars to contain. After considerable review of available documents, interviews with the principal parties involved in the prescribed burn, and extensive discussion amongst ourselves we believe that there were clearly two interconnected reasons why this happened.

- The available fire leadership at Grand Canyon was spread too thin for too long a period of time. Too many members of the fire management leadership team were out of the park on other important fire assignments for too long a period of time during this burn operation. That forced those remaining in command positions at the park to assume multiple duties and roles while the prescribed burn was active. This diverted their focus and drained their energies.
- The *Outlet Prescribed Fire Project Plan* did not contain any clearly documented benchmarks or “triggers” detailing a necessary escalation in the minimum holding/escape/contingency resources required as the complexity and size of the prescribed burn increased. The overstretched command staff was, in this situation, working at an increasingly fevered pace without the benefit of pre-set guideposts to show them they were under-staffed.

Again, the prescribed burn program at Grand Canyon National Park is fundamentally sound. Continuation and even expansion of current program levels is absolutely necessary to safeguard the park from the effects of nearly 100 years of fire exclusion. However, the issues of overtaxed fire leadership and absolute benchmarks of resource requirements that respond to increasing burn complexity must be addressed.

Closing

In closing the Team would like to thank the Superintendent and staff for their logistical support and administrative assistance. The park prepared four large binders of pertinent background materials (plans, radio logs, daily reports, weather and fire behavior observations, press releases, etc.) that were ready for us upon arrival. All requests for additional documents were readily supplied when available. Those interviewed were candid and straightforward in their responses to our questions. While understandably anxious, the Team's general impression was that the park viewed their work as a means to find ways to improve the program and to avoid the recurrence of an Outlet Wildland Fire.

We are a relatively small team that worked under a tight deadline. Even so, the Team believes that no significant facts pertinent within the scope of our delegation of authority escaped attention.

Appendix A

Memorandum:

Regional Plant/Fire Ecologist to Regional Director, Western Region
October 23, 1981



United States Department of the Interior

NATIONAL PARK SERVICE

WESTERN REGION

450 GOLDEN GATE AVENUE, BOX 36063
SAN FRANCISCO, CALIFORNIA 94102

IN REPLY REFER TO:

October 23, 1981

Memorandum

To: Regional Director, Western Region

Through: Associate Regional Director, Resources Management, Western Region
Assistant Regional Director, Natural Resources
Chief, Division of Natural Resources Management

From: Regional Plant/Fire Ecologist, Division of Natural Resources
Management, Western Region

Subject: Trip report for Grand Canyon National Park

From September 14 through 18 I visited Grand Canyon on request of Natural Resources Management staff to confer about fire management. During the visit I spent time with John Ray (Division of Natural Resources) on both rims looking at vegetation and fuels situations, particularly around developed sites. I am alarmed by heavy fuels and unnaturally dense forests resulting from decades of fire suppression. These are hazardous situations that can easily support uncontrolled, intense fires capable of killing people, burning developments, and damaging natural resources because they are too hot.

In this report I want to emphasize my concerns for fire safety then give recommendations for fire management. First is discussion of potentially hazardous situations that threaten people and developments. Natural scenery around visitor centers, residences, headquarters, roads, etc., is typically "preserved" in Park Service management by attempts to exclude cyclic natural disturbances that created the original scenery. At Grand Canyon, the primary cyclic disturbance is fire. The following hazardous fuel situations occur in the park as a result of vegetation succession and seven decades of suppression:

1. Piles of fallen dead pinyon and juniper trees occur around Desert View and Grand Canyon Village that are readily available fuel for fire starts. When dry, piles burn intensely with increased spot fire potential.
2. Continuous tree cover grows along East Rim Drive and especially along north rim road systems. There is rarely significant diversity of age, class or structure that would serve as fuel breaks.

3. Plant succession has created fuel ladders of continual vegetation from ground to tree top capable of torching out, i.e., bursting into flames. On the south rim this can be seen near the visitor center where pinyon and junipers grow underneath and interlace canopies with tall, old ponderosa pines. Some of these grow near the Mather Amphitheater and residences, which are mostly wooden structures. Plant succession on the north rim has led to dense tree cover, continuous canopies, and fuel ladders throughout the forests that can easily carry wind-driven crownfires.

4. Several areas on the north rim have concentrations of fallen, dead trees, which are heavy fuel loads that increase fire intensity and hinder suppression efforts. Heavy concentrations are next to U.S. Forest Service land and call upon us to be a responsible neighbor. Logs from right-of-way clearing and felling as well as deadfall are in piles by the maintenance yard, employee residences, and ranger station on the north rim. As stated before these would burn intensely and increase spot fire potential.

I am concerned about these fuel situations because the potential exists for intense crown fires burning into developed areas and trapping people. The De Motte (USFS), Saddle Mountain, and Pistol wildfires were intense, rapidly moving fires mostly in standing vegetation that became uncontrollable minutes after ignition. I don't like to think of the consequences if any had burned into Grand Canyon Village, the north rim complex, or any one of the viewpoints where visitors stop to enjoy the canyon. There is plenty of deadfall, dense vegetation, wood structures, propane tanks, and people to make a catastrophe.

The second aspect is fire safety for natural resources. Due to increased fuel loadings they are in danger of being burned by fires that are just too hot. Consequently, the effects of abnormally intense fire would cause severe impacts to animals, plants, soil, watershed, etc.

Fire histories for forested areas can be given for broad vegetation communities; the pinyon-juniper forests and mixed conifer forest. Pinyon-juniper forests have discontinuous ground cover and often trees are far enough apart that canopies do not touch. Historically, fires were small-area burns around fallen trees and snags. Or, if influenced by wind they were carried through the canopy burning larger areas, the size depending on wind and available fuels. Wind is essential to spreading fire in pinyon-juniper stands.

On the south rim, mixed conifer forests are ponderosa pine stands and the ecotone transition between pine and pinyon-juniper stands. On the north rim, mixed conifer includes ponderosa pine, Douglas-fir, engelmann spruce, white fir, blue spruce, and white pine. My evaluation is historical fires in mixed conifer forests were not intense, widespread crownfires. Instead, they were low to moderate intensity fires that kept an open forest structure, thinned

regeneration, and prepared seedbed. Undoubtedly there were flare-ups on moist aspects or in dense regeneration, but generally fires burned ground fuels. Everywhere I went I saw evidence that "natural" forests were open stands with a few dominant individuals over uneven-aged regeneration.

My evaluation of fire history is based on field observations. Monarch ponderosa pines and Douglas-firs have large lower branches indicating an open forest condition kept open by periodic fires, which also maintained low fuel levels hence low intensity fires. These are well-known early seral species. The understory is more shade tolerant species, and ponderosa and Douglas-fir regeneration is rarely found. Not only is a change of forest composition occurring, but shade tolerant species, especially firs and spruces, grow into overstory canopies and provide fuel ladders to carry fire into crowns to kill big trees. Another sign of intensity is the lack of snagfields, which would be remnants of past crown fires. Also there are not extensive even-aged stands.

Historic fire frequencies vary. In pinyon-juniper forests intense fires probably occurred at frequencies of 40 to 60 years. Little study has occurred in this forest type so the frequency is estimated from literature and conversations with others. Small area fires in dead trees occur more often.

In mixed conifers there is a wide range of frequencies. Studies of cross-sections taken from fire-scarred trees on the north rim show a frequency of 7 to 10 years on ponderosa sites. Literature confirms this for northern Arizona pine stands. Near the Saddle Mountain burn, fire-scarred stumps (USFS land) roughly indicated a frequency of 20 years. Many old trees with multiple scars were found. No work has been done at Grand Canyon in more moist mixed conifers, and I was unable to find any in the literature or from fire friends. However, John Ray and I examined external fire scars on old ponderosa pines and Douglas-firs near Point Sublime and estimated a frequency of 40 years. We found one old pine (400+ years) with nine scars. Along a one mile section of the fire road I counted 27 burned out snags (old monarchs). This was the greatest number I found and indicated to me past fires were hotter in this locality. This is logical since it is also where we found the longest fire frequency.

These fire frequency estimates help us to understand existing fuel situations. Historically, crownfires were rare, occurring mostly on small areas of continuous tree cover. Now after 70 years of fire suppression, dense vegetation growth creates continuous vertical and horizontal fuel in addition to piles of fallen trees and increased fine litter depth. Greg Goodwin, Wildlife biologist, Coconino National Forest, USFS, told me old photographs of mixed conifer forests in northern Arizona on the Coconino and Kaibab National Forests show forests now are over twice as dense as they were 40 to 70 years ago. Ample fuel is available for widespread crownfires; one only has to look at recent wildfires for confirmation.

This is a situation current park management has inherited as a result of the total suppression policy carried out by NPS for so many years. Park staff has conducted a few prescribed burns in the last few years to break up continuous fuels and restore more natural conditions. Natural Resources Management Staff is now beginning to organize fire management parkwide.

Following are my recommendations to develop and enhance a fire management program that includes prescribed fire and suppression. These have been discussed with members of Grand Canyon staff during my visit and in subsequent conversations:

1. Reduction of hazardous fuels around developments in order to protect people and facilities should be top priority. This could be done with a combination of fire and mechanical means. Following are areas where I recommend to start:

a. North rim complex--Reduce right-of-way logging slash that is piled near the maintenance yard, residences, and ranger station. There are so many logs in situ that burning without some manipulation would be too hot and kill trees. Throughout the north rim complex there are concentrations of deadfall around trailer residences, by the sewer plant, in the gully by the heliport, around concessionaire employee housing, and close to propane tanks. Propane tanks are explosive. They discharge like dynamite when exposed to long periods of high heat or ignited by sparks.

I feel a good use of logs and deadfall is firewood made available to visitors and residents. By using summer fire crews to cut wood, they will get experience with chainsaws and do constructive work while staying close to the fire station. At the same time they are reducing hazardous fuels. Smaller logs could be used for benches, bumper logs, etc. Some downed wood should be left for wildlife purposes and to prevent the appearance of a manicured plantation. This can be done while breaking the most potentially hazardous fuels. After working within the complex, crews can reduce deadfall by prescribed burning of forests along the road from Cape Royal turnoff to the ranger station.

b. NPS/USFS northeastern boundary--Concentrations of deadfall along this boundary are unnaturally heavy fuels resulting from suppression. If ignited during high fire danger, intensity would cause tree kill and scorch, torching out, spotting, and long duration of heat penetration into the soil. Park staff plans to burn some of this after sufficient snowfall. That would lessen intensity and facilitate control. Some standing trees will likely be scorched and possibly killed. Due to fire exclusion, forest density has increased so there is not much chance of avoiding this. However, it will be beneficial and fit management objectives because it will open the canopy, prepare seedbed for seral species regeneration, and break up fuel continuity.

c. Desert View, Grand Canyon Village, and rim drive pullouts and viewpoints: In surrounding pinyon-juniper forests, fallen trees provide ignition sources for lightning and human-caused fires. Burning most piles of dead trees for a specified radius around these sites would enhance safety. Some can be left for wildlife habitat and aesthetics. If burning is done in cool weather, perhaps even in winter with snowcover, scorch of surrounding trees will be minimized.

2. A current presuppression plan would help organize response during fire emergencies. This plan identifies escape routes, refuges, suppression forces available, fuel breaks, road systems, water sources, heliports, fire caches, warning systems, lines of defense (roads, ridges, fuel breaks), extremely hazardous fuel situations (wood houses, propane tanks, log piles), ignition patterns (lightning and human-caused fires), etc. Responsibilities of individuals should be clear, and the plan should be prepared and reviewed by all divisions.

A plan is especially important for the north rim complex where there is only one road for evacuation. If that road is blocked by fire or incoming suppression forces, where do visitors and residents go? All roads lead to the rim and most are densely wooded on both sides.

North rim complex, Grand Canyon Village, Desert View, and the pullouts and viewpoints should be made safer by reducing dead and live excess fuels. It is better to have people grouped at prepared refuge areas than panicking and trying to escape via blocked roads. Studies have shown that buildings, cars, and unburnable areas (parking lots, bare rock) offer better chances for survival than trying to race fast headfires and smoke.

3. Prescribed fire (natural and planned ignition) should be coordinated and organized parkwide and involve all divisions. The current fire management plan is being revised by natural resources management personnel. A primary focus is to get support and involvement from all levels of park staff so it will be a park program rather than considered a natural resources management division program.

A successful program is based on understanding and support of in-service people. This includes training suppression crews, interpreters, rangers, resource managers, volunteers, and maintenance staff about fire ecology and NPS management objectives by prescribed fire as well as suppression. Training can be given as the plan develops through interpretive services, during staff meetings, in fire suppression courses, etc.

Prescribed burning is cost effective. It costs less per acre and achieves more management objectives than total suppression. The Hearst and Vista burns are excellent and achieve a variety of fire effects, diversity, and fuel reduction. I compliment park staff for safely conducting burns in abnormal live and dead fuel loadings and forest density.

4. The fire program should be based on clear understanding of fire ecology and fire history of park ecosystems. If we do not understand these then we really do not know the effects of burning, how frequently to burn, types of fire intensity and spread to expect currently and under more natural conditions, and whether specific management objectives are attainable.

John Ray determined fire history for the Vista burn site in addition to fuel sampling. More selective sampling like this should be done on both rims since our field observations indicated a range of fire frequencies. Samples taken for the Vista burn simply will not represent all the forested areas. John and I found several trees with multiple scars that could be sampled. This and monitoring burned (prescribed fire and wildfire) and unburned comparison will provide ecological interpretation.

We classified forest communities on both rims using habitat type keys for ponderosa pine, spruce-fir, and mixed conifer stands. Habitat typing is a land-vegetation classification system based on the potential climax of a site. Effects of management practices or natural factors within a habitat type can be understood and predicted in terms of seral communities, growth rates and potentials for species, and rates of succession. Habitat type classifications used with the new vegetation map for Grand Canyon will give managers an ecological basis for predicting effects of prescribed fire and continued suppression. Also, results of Pete Bennett's (CPSU scientist) fire ecology work can be incorporated and used to refine prescriptions and describe effects.

5. Interpretation is essential for effectively launching and implementing a prescribed fire program because of messages the public has received about prevention and "fire is bad" for 40 years. It is important to recognize two publics: the in-service public (NPS) and out-service public (visitors, other agencies, etc.). Education of and support from the in-service public is crucial because these people have contact with the general public and opportunities to explain how and why park staff uses fire.

Natural Resources Management staff at Grand Canyon recognizes this critical link. Consequently, they are involving various divisions and individuals in the plan revision. The Grand Canyon team attended the 1981 Prescribed Fire Workshop at Yosemite NP, and members were from three divisions; interpretation, natural resources, and visitor protection. They are working jointly to make displays, brochures, and slide/tape programs and conduct burns.

There are two areas typically of concern for in-service and out-service publics: black or scorched trees and smoke. Basically it comes from misunderstanding (or lack of understanding) of fire ecology and socialized aesthetic values--green trees are nicer to look at than black or brown trees. We almost have to de-program the thinking that fire does not belong when in fact it is a powerful ecological agent. And, we have to explain that we want fire to thin forests by killing some trees, because if the natural fire regime had continued during the past 70 years most of the understory would not be there today.

Smoke is also something many people will accept if it is wildfire smoke but have trouble tolerating if it is prescribed fire smoke. There are trade offs to explain. For example, intense wildfires produce more smoke because more fuels are consumed, and there is less control on where it flows. Grand Canyon staff

recognizes management of prescribed fire smoke is essential to the acceptance of the program and have put more effort into smoke management since it became an issue during the Vista burn in 1980.

I congratulate park staff for carefully planning burns. Evidence shows fire is historically frequent in the forest communities, and as a consequence of suppression several fires have not occurred. Forest stands are over twice as dense as they should be, litter is three to four times greater than natural loads, and heavy deadfall is a nightmare. Park staff recognizes these hazards and realizes a series of low to moderate intensity fires over several years will be required to restore ecosystems. One fire cannot correct 70 years of suppression. It took 70 years to get to this state, and it will likely take 70 years to restore. The people applying fire have done so with an ecological conscience while burning in abnormally heavy fuel loads.

6. Impacts of suppression often last longer than signs of fire, and I appreciate Superintendent Marks objecting to heavy-handed suppression he felt was unnecessary. Since the park is preparing a total fire plan, a thorough review of suppression tactics should be taken. Sometimes it is sufficient to contain fires by letting them burn out to natural barriers or using backfires or narrow handlines for control. Drastic actions, like felling mature trees, using heavy equipment, and cutting trail through sensitive areas (meadows), should be justified.

I strongly recommend fire crews and leaders use low impact suppression techniques. Also, resources advisors should be called to consult on suppression, especially if fires escape initial attack. Fire ecology of Grand Canyon ecosystems should be included in fire suppression training at the beginning of the fire season. This would give crews awareness of fire behavior potential in Grand Canyon fuels and appreciation for impacts on natural resources. Trees that have lived 400 years through drought, freezes, lightning, fires, insects, diseases, etc., should not needlessly fall to a chainsaw. This happens in many parks, which emphasizes the importance of a resources advisor on fires.

This report has dealt mostly with fire management of vegetation and fuels. There are two other facets I will discuss: watershed and wildlife. Excess fuel is extra litter and debris that acts as a sponge. Extensive research states watersheds improve with prescribed burning. By reducing fuels, more precipitation will flow into the ground water system and into the canyon. Also, more surface runoff ponds may form and become available for wildlife.

The beneficial effects of fire for seral wildlife species is well known. Wildlife at Grand Canyon evolved with fire, and as such returning fire would enhance habitat requirements of food, water, shelter, territorial space, etc. To emphasize the interdependence of some animals and fire, I found information in Joseph Hall's report (1981) about the tassel-eared Kaibab squirrel. Pure or nearly-pure ponderosa pine stands are Kaibab squirrel habitat. Hall stated an overzealous program of fire suppression has degraded the habitat since it changed the nature of many forests. He quoted another author who said Arizona pines were open and parklike

in the 19th century. This change has been properous for the red squirrel, an aggressive competitor of the Kaibab squirrel. Without fire, the Kaibab squirrel population at Grand Canyon is dwindling with decline of ponderosa pine forests.

Revising the fire management plan is a regular updating process to incorporate new information on prescriptions, ecology, smoke management, and personnel organization. Larry May, Chief of Natural Resources Management Division, is providing direction and organization to fire management and ensuring that all divisions and the Superintendent's staff ~~is~~^{are} involved and informed of progress. It is encouraging to find the park cooperating on fire management, which is truly an interdivisional program.

Kathleen M Davis

I concur:

Associate Regional Director,
Resources Management, Western Region

Date

Approved:

Regional Director, Western Region

Date

Appendix B

Memorandum:

Steve Botti, et al. to Superintendent, Grand Canyon National Park
1997

Memorandum

To: Superintendent, Grand Canyon National Park

From: Steve Botti, Fire Program Planning Manager, Fire Management Program Center,
NIFC
Jim Douglas, Senior Fire Policy Advisor, DOI Office of Managing Risk and Public
Safety
Wally Josephson, Fire Management Specialist, DOI Office of Managing Risk and
Public Safety
Steve Tryon, BLM Budget Analyst, DOI Office of Budget

Subject: Hazard Fuels Reduction Program Analysis and Site Visit, North Rim of the Grand
Canyon

On August 12, 13, and 14, 1997 we reviewed Grand Canyon National Park's prescribed burning program on the North Rim, along with the fire history and forest ecosystem restoration research currently being conducted by Northern Arizona University at Mt. Trumbull and on the North Rim. We wish to express our appreciation to the park staff for participating in this review and assisting with arrangements. Special thanks are due Dan Oltrogge, Bob Winfree, Ken Kerr, Steve Bone, and Johnny Ray for their insights into fire and ecosystem management issues as well as their willingness to discuss the socio-political context within which these issues must be viewed by park management.

As you know, both Secretary Babbitt and Congress have expressed strong interest in reducing the number of large wildfires along with their accelerating costs and resource damage. In support of this goal, they have advocated expanded hazard fuels treatments and restoring forest health through fire use and mechanical treatments. Since the prescribed burning and mechanical fuels treatment programs on the North Rim and at Mt. Trumbull may establish significant interagency precedents for how to accomplish these goals, we felt that it would be beneficial to have a group of Interior fire policy and budget officials review the current situation. We all felt that this trip was informative and beneficial in the continuing debate over the proper mix of methods to achieve fuels and ecosystem management goals.

We commend the staff of Grand Canyon National Park for their willingness to explore innovative and challenging solutions to the difficult fire management problems on the North Rim. The NPS Fire Management Program Center and the Department will strongly support your efforts.

The attached trip report provides a synopsis of our impressions on these issues following our brief site visit.

TRIP REPORT: NORTH RIM OF THE GRAND CANYON FIRE MANAGEMENT PROGRAM REVIEW

August 12-14, 1997

Steve Botti
Jim Douglas
Steve Tryon
Wally Josephson

The North Rim has been selected as a study site for research on mechanical restoration of pre-settlement forests conducted by Dr. Wallace Covington at Northern Arizona University. That research, combined with the on-going prescribed natural fire and prescribed burning programs by the National Park offers an excellent opportunity to compare and contrast the relative effectiveness and practicality of prescribed fire and mechanical fuels removal for restoring natural forest structure and reducing fuels that have accumulated far beyond the natural range of variability. The debate on this issue between university scientists, park scientists, foresters, and fire managers has continued for the past 17 years. Recently, the debate has become national in scope as hazardous fuels accumulations have generated ever increasing numbers of large, intense, and damaging wildfires. Therefore, the results of the North Rim experiments and analysis may have applicability throughout many forests in the West.

While it is too early to predict the final outcome of this debate, we do wish to share some observations on current and proposed fire management activities on the North Rim, within the broader context of similar fuels and ecosystem problems throughout ponderosa pine and mixed conifer forests in the West.

The park and adjacent national forest have recognized for some time that the north rim forests have an unnaturally dense growth of under story trees due to the suppression of lightning fires and the cessation of aboriginal ignitions in the late nineteenth century. The continued encroachment of these "ladder" fuels under what was naturally an open canopy of pines and firs, together with the heavy accumulation of dead and downed fuels, has created the potential for widespread crown fires that will further disrupt the natural ecosystem and endanger public safety, cultural resources, park facilities, and market resources on the Kaibab National Forest.

The park has attempted to reduce this threat by prescribed burning several blocks on the North Rim. Unfortunately, prescribed burning on the North Rim has met with limited success. The suppression of both the Matthes Prescribed Burn and the Northwest III Prescribed Burn, along with concern over smoke impacts, has led to a conservative approach to reintroducing fire as a management tool for restoring the forest ecosystem and reducing hazardous fuels. It was clear from this meeting, however, that the park staff now supports a more aggressive prescribed burning and fuels treatment program using the full range of tools available.

At this and other meetings, and in published literature, some experts have expressed the opinion that prescribed burning in ponderosa pine/mixed conifer forests with heavy fuel accumulations and fuel ladders is too risky, both to burn team personnel and to natural and cultural resources

unless the forest is first mechanically thinned and the resulting biomass removed. This belief is reflected in the philosophy and methodology of Dr. Wallace Covington and his team from the College of Ecosystem Science and Management at Northern Arizona University. Testing the truth of this hypothesis should be a central component of the Park's fire management program over the next five to ten years. In order to help resolve this question, we recommend that the park begin to analyze the ten years of fire effects monitoring data that it has collected on past prescribed burns. These data will reveal whether long-term vegetative response and fuel loading trends are meeting management objectives. Both the fire management staff and the natural resources staff expressed an interest in completing this work, but so far little has been accomplished. The Inter-mountain regional fire staff has offered to assist with this effort if needed, and the national fire office also would be happy to arrange for data analysis support. It is critical that this analysis be completed in conjunction with similar work on the NAU plots in order to compare the results of the different methods. If the park implements a more aggressive prescribed burning program, as planned, it will be essential that fire effects data be collected and evaluated to determine the baseline conditions of fuels, forest structure, and key ecosystem components, and long-term changes produced by the burning.

While the level of hazardous fuels on the North Rim is a difficult management problem, it is not without precedent in the Service. Fuels accumulations in other ponderosa pine/mixed conifer ecosystems, such as in Yosemite, Sequoia & Kings Canyon, Lassen and Crater Lake national parks are equally as great, and in some cases present greater management difficulties. It has yet to be proven that either prescribed burning alone or in combination with mechanical treatments can correct the fuels problem quickly enough to prevent large, catastrophic wildfires. However the risks of no action far outweigh the risks of prescribed fire or mechanical thinning. There is no doubt that without intervention to modify the fuels complex, a unnatural and catastrophic wildfire will sweep across tens of thousands of acres on the North Rim within the next few years.

Dr. Covington's Forest Ecosystem Restoration Project offers one possible solution to this dilemma. By removing up to 90 percent of the forest and shrub biomass, and restoring a "pre-settlement" forest canopy, the NAU experiment has substantially reduced the wildfire risk on Mt. Trumbull and elsewhere in Northern Arizona. Whether this model truly mimics presettlement ecosystem conditions is still to be proven, as is whether these vignettes of the pristine ecosystem can be expanded to landscape scale in Grand Canyon National Park.

The principal advantages of the NAU approach are as follows:

- Risk to personnel safety, developments and resources from prescribed fire escape is reduced.
- The model for dating trees produces a specific target forest overstory structure as a management goal.
- Hazardous fuels are removed and the resulting forest structure permits the immediate restoration of a natural fire regime, or prescribed fire to mimic the natural regime.
- The forest restoration system generates income through the sale of timber, which can be used to partially pay for the treatment.
- The sale of timber and firewood can be beneficial to the local economy.

- Political, social, and regulatory problems associated with large smoke emissions from prescribed burns is reduced. The problem is not eliminated because the NAU methodology calls for follow-up prescribed burning to clean up debris left by the thinning operation and to restore the natural fire process into the fire dependent ecosystem.

The principal disadvantages of the NAU approach are as follows:

- Removing up to 90 percent of the trees throughout the North Rim would create intense public controversy by producing a significant impact on traditional visitor expectations for visual quality and natural quiet in a national park.
- Logging operations may conflict with the proposed wilderness designation of much of the North Rim.
- There may not be enough time to complete extensive mechanical fuels removal before a catastrophic wildfire occurs. Such an event would destroy any possibility of mechanical ecosystem restoration for many decades. The experience on Mt. Trumbull indicates that logging and slash burning a few acres per year is no easy task. The logistical difficulties of treating thousands of acres per year would be even more daunting. Prescribed burning thousands of acres of slash would present significant control difficulties. If left unburned, such slash might increase the potential for catastrophic wildfire, as has proven the case on many logging sales throughout the west. Burning slash from the ecosystem treatments on one block on Mt. Trumbull severely scorched and killed many of the leave trees and almost escaped control. The number of trees to be removed throughout most North Rim areas would be at least twice as many as on the Mt. Trumbull plot; thus safely treating the slash would prove even more difficult.
- The restoration work produces hundreds of stumps per acre, which become prominently visible after burning the slash. These stumps will remain visible for many decades.
- Restoring the presettlement shrub/herbaceous components following this treatment methodology appears more difficult and less successful than the immediate restoration of presettlement ponderosa pine. There is less quantitative data about the nature of these components in presettlement times, and the extensive ground disturbance with logging machinery, skid trails, and slash burning create an ideal environment for non-native weed species to invade.
- Despite income from logging sales, extensive tree thinning may prove prohibitively expensive compared to prescribed burning.

The difficulties associated with large-scale prescribed burning on the North Rim are well known. Smoke impacts together with the potential for fires to escape prescription will always remain a problem. However, it appears that a greatly expanded program to utilize fire as a management tool offers the best hope for preventing catastrophic wildfire and restoring the natural ecosystem in the long run. Many of the mistakes of the past can be avoided by utilizing the new funding for hazardous fuels operations to procure the necessary resources to carry out large-scale burns on an opportunistic basis. The Grand Canyon fire management staff have already recognized this approach, and are now utilizing aerial ignition to burn large areas whenever favorable weather, fuel moisture and smoke dispersal windows occur.

Planned ignitions, possibly coupled with mechanical thinning, can be used to treat key areas to create buffers and protect boundaries. Once key areas are secured, lightning fires can be used on a more extensive basis to achieve management objectives. Now that new NPS fire policy has eliminated the rigid division between a suppression fire and a prescribed natural fire, management has the option to use multiple management strategies on individual fires to protect resources at risk while using a fire to achieve resource objectives in other areas.

The belief that forests across the North Rim have uniformly drifted far away from their natural state and are characterized by heavy concentration of hazardous fuels was not supported by our observations. Many areas of ponderosa pine forest still retain their natural open character, and could be prescribed burned with little difficulty. Other stands are probably not as open as they were in the 19th century, but also have not produced excessive concentrations of fuels that would prohibit prescribed burning without preliminary mechanical treatments. The 1994 Report on the North Rim Hazard Fuels Situation recognized this fact, and recommended that these areas serve as the initial focus of a restoration program, to be followed by the treatment of more difficult areas. This is still good advice. Maintaining these areas while gradually expanding buffers around the areas of greatest hazard will reduce the threat of an escaped prescribed fire. Prescribed fire treatments should accelerate once the worst problem areas are isolated.

Mechanical removal of some trees and downed fuels may be another useful “tool in the toolbox” for managers. It could be used to create buffers along roads, along other key boundaries, and around developments so that prescribed fire can be used more safely. Dr. Covington’s ecosystem restoration experiment will provide a basis for evaluating the short and long-term effects and benefits of mechanical fuel removal. The park is to be commended for broadening the scope of the research to include a comparison with direct introduction of prescribed fire and an intermediate treatment involving removing enough biomass to restore the forest to within the range of natural variability, without complete restoration to the 1870 presettlement target. Selective thinning to restore the forest to the upper end of fuels variability will allow safer prescribed burning in some areas and more rapid restoration of the natural fire process. However, selective thinning of under story trees combined with moderate intensity prescribed fire may remove fuel ladders, but also fire-proof the sub-canopy trees that have grown above 50 feet tall during the past 120 years. The unnatural density of these trees will continue to provide an avenue for wind-driven crown fires for some time if they are not thinned by fire or mechanically. A possible solution to this problem would be to mechanically remove some of these trees rather than the smaller under story ones, and then use prescribed fire to thin the smaller trees. This would allow the use of safer, more moderate intensity prescribed fires while still achieving the desired open forest structure in the long run.

An inspection of the Matthes and Northwest III prescribed burns, which were suppressed for escaping or threatening to escape prescription, revealed long-term ecosystem and fuels reduction effects that compare favorably with the Mt. Trumbull experiments. Areas on the Northwest III fire that were considered “too hot” for prescription actually produced excellent thinning of under story trees while scorching fewer of the presettlement ponderosa pine than did a slash burn on Mt. Trumbull. Areas that “torched” on the Matthes and Northwest III fires also produced an excellent regeneration of native shrubs and herbs without the need for reseeding or planting. So far, this has not been true on Mt. Trumbull. Numerous studies over 30 years in the ponderosa

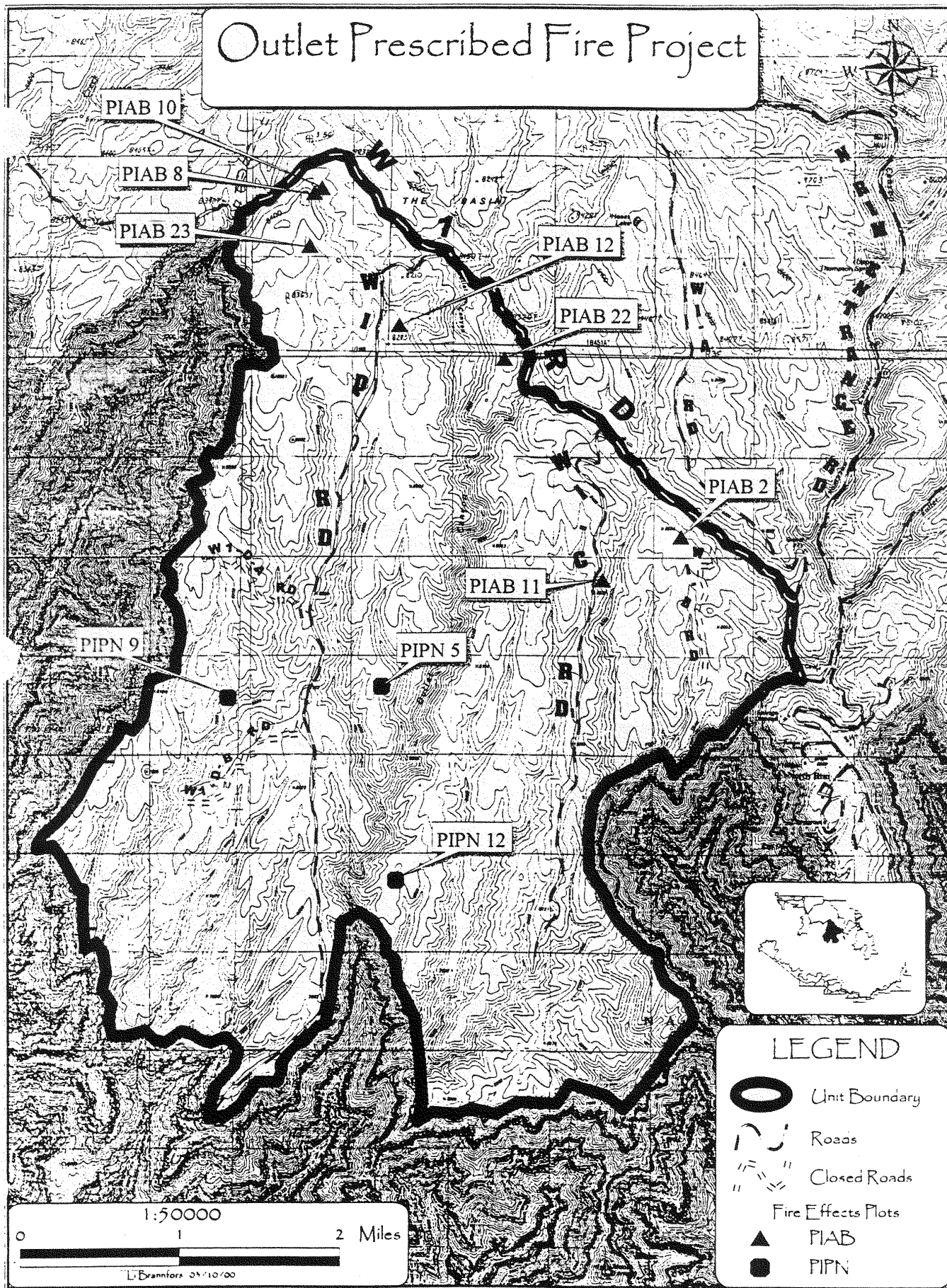
pine mixed conifer forest has confirmed that localized “hot spots” were a natural occurrence and helped maintain the uneven aged mosaics of even aged trees in the forest. Any prescribed burning program on the North Rim should allow for such hot spots and their beneficial ecological effects.

As compared with Mt. Trumbull, the only problem with fire effects on the Matthes and Northwest III fires was the large number of standing dead trees, which will fall in future years to increase fuel loading once again. This problem can be solved by multi-stage burning over 10-20 years, in which subsequent burns remove incremental amounts of the dead trees as they fall to the ground. The problem throughout most western parks in this regard has been the lack of determination and resources to complete the second and third generation prescribed burns on a reasonable schedule. In summary, we believe that the park’s existing program to restore a more natural ecosystem and reduce hazard fuels through prescribed burning and the opportunistic use of unplanned ignitions should not be stopped or reduced in favor of an emphasis on the NAU approach of mechanically removing trees and burning slash. In fact, the prescribed burning program should be accelerated wherever possible utilizing the additional funding provided in the 1998 appropriation. Congress and the Administration have both recognized the time-urgency of addressing the hazard fuels problem, and the North Rim provides an excellent opportunity for the NPS to provide leadership in this area. The NAU research will provide additional information on the fire history of the North Rim and the viability of mechanical fuels removal. In time, NAU treatment methods may be used to augment the prescribed burning program, and accelerate restoration of natural fire regimes on the North Rim.

Appendix C

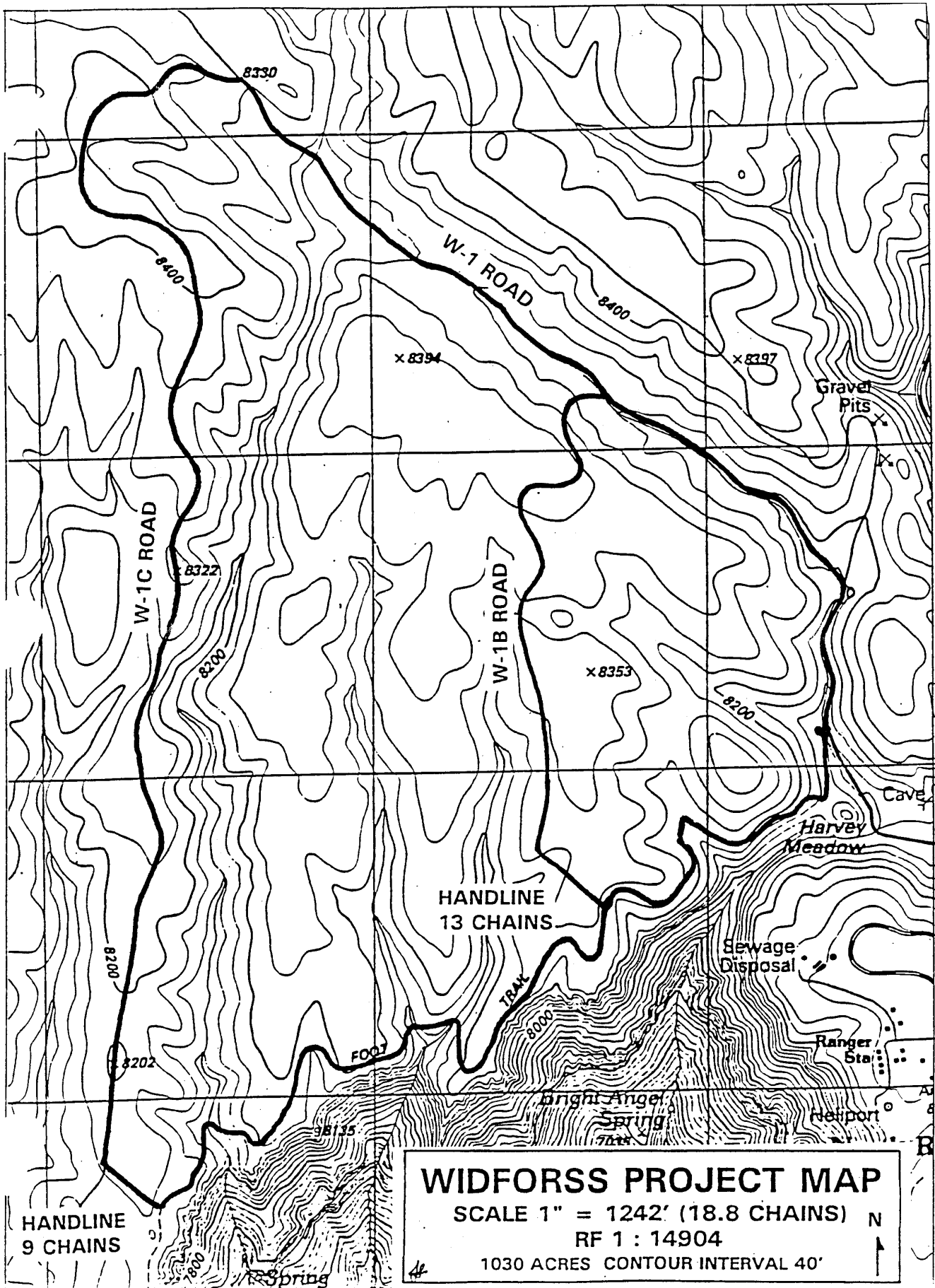
Map of Outlet Fire Project

Outlet Prescribed Fire Project



Appendix D

Map of Widforss Sub-unit



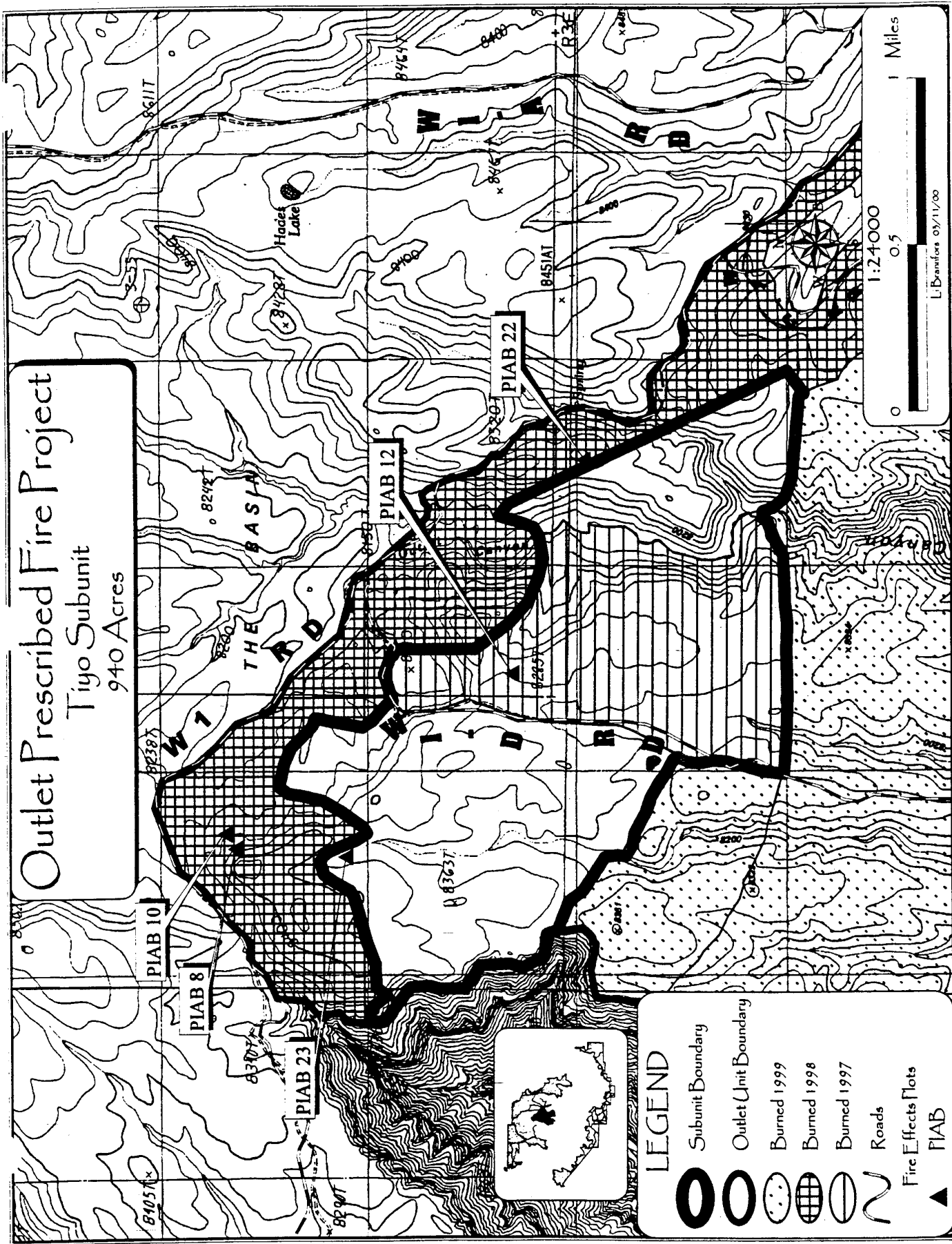
Appendix E

Map of Tiyo Sub-unit

Outlet Prescribed Fire Project

Tiyo Subunit

940 Acres



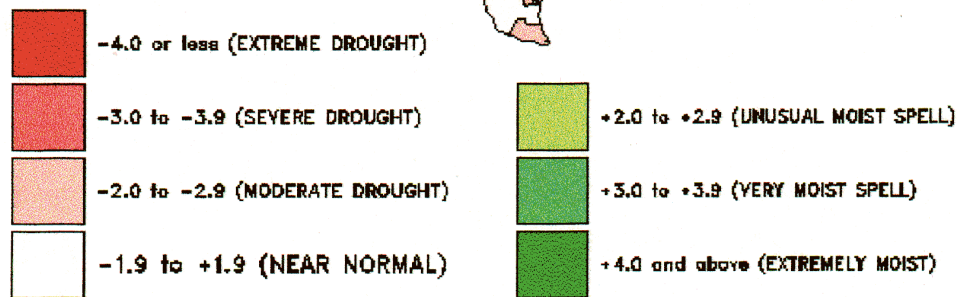
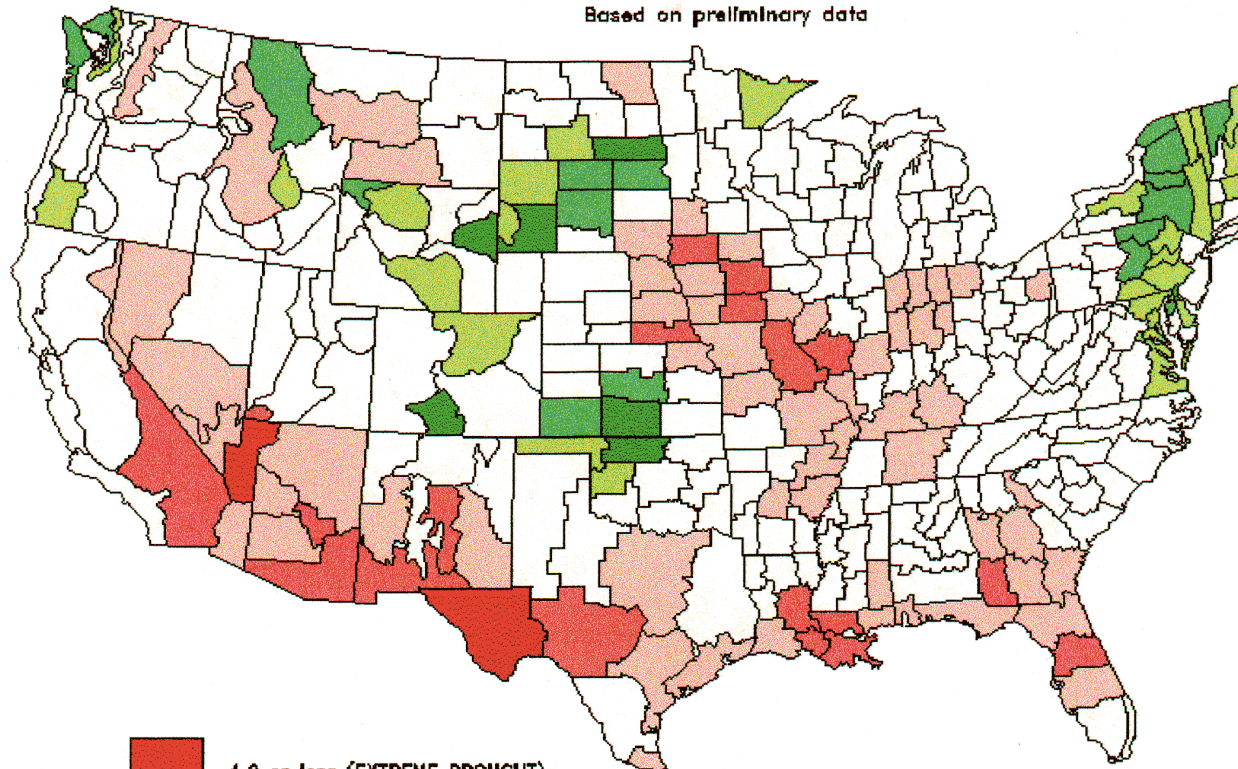
Appendix F

Drought Severity Index
April 22, 2000

DROUGHT SEVERITY INDEX BY DIVISION (LONG TERM PALMER)

APR 22, 2000

Based on preliminary data



CLIMATE PREDICTION CENTER, NCEP

Appendix G

Delegation of Authority

From Superintendent Robert L. Arnberger to Investigative Team Co-chairs



IN REPLY REFER TO:

United States Department of the Interior

NATIONAL PARK SERVICE
GRAND CANYON NATIONAL PARK
P.O. BOX 129
GRAND CANYON, ARIZONA 86023-0129

A96 (GRCA 8211)

Memorandum

To: Superintendent, North Cascades National Park, NPS (Co-Chair)
Forest Supervisor, Bitterroot National Forest, USFS (Co-Chair)

From: Superintendent, Grand Canyon National Park

Subject: Outlet Prescribed Fire

I have requested a fire investigation, with the concurrence of the Director, National Park Service, through the National Interagency Fire Center. This letter constitutes the delegation of authority for the Interagency Fire Investigative Team. The Investigative Team will follow NPS (National Park Service) procedure as described in Chapter 13, Evaluation and Review, Reference Manual 18.

The purpose is to investigate the circumstances associated with the planning and execution of the Outlet Prescribed Fire in Grand Canyon National Park and determine if overall NPS guidance and procedures were followed. The Investigative Team will examine events and circumstances during the time period beginning with planning and implementation of the prescribed fire to the declaration as a wildfire for suppression.

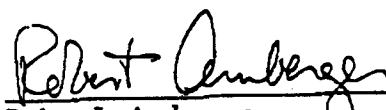
Specific objectives for this investigation include:

1. If the Prescribed Fire Plan was adequate given the complexity, objectives and environmental conditions, and if it complied with NPS guidance set forth in Director's Order No. 18 and Reference Manual 18.
2. If the prescription, actions and procedures set forth in the Outlet Prescribed Fire Plan were followed.
3. If prescribed fire training and experience of personnel involved were commensurate with agency qualification standards.

Grand Canyon will assign staff assistance to the investigative team to assist in gathering information vital to the investigative process. Those individuals are Ken Kerr, Liaison and Katie Kiel, clerk.

The Investigative Team will complete work by close of business May 22, 2000. The findings of the Investigative Team will be reported to the Superintendent, Grand Canyon National Park.

The delegation shall go into effect at 0800 hours (DLS) on May 18, 2000.


Robert L. Arnberger

May 15, 2000
Date



IN REPLY REFER TO:

A96 (GRCA 8211)

United States Department of the Interior

NATIONAL PARK SERVICE
GRAND CANYON NATIONAL PARK
P.O. BOX 129
GRAND CANYON, ARIZONA 86023-0129
MAY 19 2000

Memorandum

To: Superintendent, North Cascades National Park, NPS (Co-Chair)
Forest Supervisor, Bitterroot National Forest, USFS (Co-Chair)

From: Superintendent, Grand Canyon National Park

Subject: Outlet Prescribed Fire Project

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The purpose is to investigate the circumstances associated with the planning and execution of the Outlet Prescribed Fire Project in Grand Canyon National Park and determine if overall NPS guidance and procedures were followed. The Investigative Team will examine events and circumstances during the time period beginning with planning and implementation of the prescribed fire to the completion of the May 10, 2000, Wildland Fire Situation Analysis (WFSA).

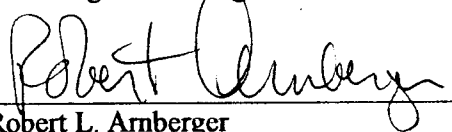
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The delegation shall go into effect at 0800 hours (DLS) on May 18, 2000.


Robert L. Arnberger

5/18/00
Date

Appendix H

Prescription Parameters
Fire Behavior Chronology
May 21, 2000

Outlet Prescribed Fire Project
Prescription Parameters
Fire Behavior Chronology
May 21, 2000

Prescription parameters for the Outlet Prescribed Fire Project covering the Tiyo and Widforss sub-units cover a wide spectrum of potential fire behavior. This maximizes windows of opportunity for conditions which will enhance burning to meet the project objectives. This range does include some extreme possibilities should the hottest, driest, and windiest conditions be selected at the same time. At this extreme edge the resource and control objectives can not be met. However, observed fire behavior and calculated fire behavior for the conditions that existed between 4/27 and 5/09/2000 were well within prescriptive criteria to meet the resource and control objective in the plan

Ignition began on 4/27 on the both sub-units. The Tiyo sub-unit was an aerial ignition within established control lines, while the Widforss sub-unit consisted of hand ignitions to complete control lines prior to aerial ignition. The Widforss burn hand ignitions produced low intensity burning within the surface fuels with flame lengths under 1 foot in the shaded areas and moderate fire behavior in the more open exposed fuels. This lower level of activity resulted in repeated re-entry over previously ignited areas in an attempt to achieve meaningful consumption to meet control objectives in the shaded areas.

Observed fire behavior throughout the duration of the prescribed burn were flame lengths of <1-3 feet in surface litter to over 8 feet in jackpots of downed woody fuels. Most spread was slow surface movement with occasional torching of single to triple trees. This limited torching produced firebrands which resulted in short range spotting up to 300 feet. The predominate spotting direction was into the burn unit until May 9th when winds shifted to the north and west. Interior torching then became a concern as these shifting winds sent short-range spots over the control lines to the east. Since spot fires were active outside the control lines, firing ceased and all detected spots were contained by available holding forces during that operational period.

In summary the predicted, observed, and verified fire behavior during the prescribed fire behavior operations were well within acceptable limits to meet stated resource and control objectives identified in the *Outlet Prescribed Fire Project Plan*.

Appendix I

Weather reports compiled from field reports and National Weather Service

Prior to the recently completed National Weather Service (NWS) Modernization and Restructuring in Arizona, all fire weather products and services to the Grand Canyon National Park were provided by NWS Phoenix. On September 10, 1999, the NWS Flagstaff Meteorologist in Charge certified operational staff readiness to support the Fire Weather Program, effective October 13, 1999. Before program assumption, the forecast staff at NWS Flagstaff engaged in a 2 1/2 year fire weather “spin up”. This included hands-on training in the preparation of routine and special forecast products, completion of fire weather training courses, and extensive liaison with key land management officials in their forecast area, including those from the Grand Canyon National Park.

Preceding and including the period of time of the Outlet Prescribed Fire Project, routine forecasts, site specific “spot weather” forecasts, Fire Weather Watches and Red Flag Warnings (forecast products) were provided to the Grand Canyon NPS by NWS Flagstaff.

A detailed analysis was done for all the NWS Flagstaff fire weather products from April 27, 2000 to May 10, 2000. A similar review was conducted for the NPS weather observations taken on the project. It was very apparent from our analysis, coupled with personal interviews of various NPS and NWS personnel, that an excellent working relationship existed between the NPS in Grand Canyon and the NWS in Flagstaff during this period of time.

The NPS weather observations provided to the NWS and the NWS fire weather forecast products to the NPS were all received in a timely manner. These same NWS products also included the appropriate weather elements and were sufficiently accurate for the NPS to make proper management decisions during this Project. These written products were enhanced through numerous telephone coordination calls. We found no instances during this review period where NWS forecast products were grossly inaccurate, untimely or not received by the NPS. In fact, the forecast of expected high winds the next day, provided by the NWS on May 9, 2000, was a factor in the decision of the NPS to reclassify the prescribed burn as a wildland fire, prior to the arrival of these winds.

The following is a daily chronology of weather-related information and a time line of spot forecasts issued by the NWS in Flagstaff for the period April 27, 2000 to May 10, 2000.

Daily Chronology of Weather-related Information

April 27

Onsite observations

0942 & 0950	Began test fire
0956	Will start ignition at Trail Head South
11:37	Broadcast Spot Weather Forecast for burn
1310	Torching...relative humidity 20-23%
1452	Fire behavior excellent

NWS Products
0730 & 1500 Presuppression Forecast
1115 Spot Weather Forecast

April 28

Onsite observations
Surface winds squirrely and high wind above surface. High winds did not push the fire.
Low fire behavior. No runs observed within fire.

NWS Products
0730 Presuppression Forecast. Highlight: "Red Flag Warning 11am to 7pm for low relative humidity, strong winds, and high fire danger."
1115 Spot Forecast

April 29

Onsite observations
Fire behavior remained unchanged. No weather observations.

NWS Products
0730 Presuppression Forecast with a 10:15am update
1115 Spot Forecast

April 30

Onsite observations
Fire behavior remained unchanged. No weather observations.

NWS Products
0730 Presuppression Forecast

May 1

Onsite observations
No weather or fire observations.

NWS Products (Begin twice daily "fire season" presuppression forecast services)
0730 and 1430 Presuppression Forecast

May 2

Onsite observations
1100 wind 10-15 mph from east
1200 & 1300 wind 10-15 mph from east with gusts to 25
1500 wind calming down
1700 wind 5-10mph

NWS Products
0730 and 1430 Presuppression Forecast

May 3

Onsite observations

0930 Fire behavior has calmed down since last night at site 1

Fire behavior at site 2 has progressed nicely

1030 wind light and variable

1300 71 degrees...relative humidity at 33%...wind southeast 2-3 mph

1700 Wind increase pushing site 6 to the northwest. Site calms down after 45 minutes...no threat to line.

NWS Products

0730 and 1430 Presuppression Forecast

May 4

Onsite observations

0800 Hot spot at site 8

Fire activity decreased greatly overnight

1000-Noon Southeast 5-10 mph

1300 Wind southwest 5-10 mph...relative humidity 18%

1500-1700 Wind southwest 5-10 mph with occasional overhead gusts throughout the day

NWS Products

0730 and 1500 Presuppression Forecast

May 5

Onsite observations

Trail marker 8 - Hottest activity begins

0937 Winds picking up overhead

1053 Overhead winds increasing 20-25 mph...ground wind 5-10 mph with gusts to 15

Noon Southwest 5-10 mph...relative humidity 25%

1300 Southwest 10-15 mph gusts to 25 mph...relative humidity 27%

1400 Gusty south winds 20-25 mph...relative humidity 28%

1500 Southwest winds 10-15 mph. Since cloud cover moved in things have calmed down a lot, but winds continue to gust on and off

NWS Products

0730 and 1500 Presuppression Forecast. Both forecasts highlight "Red Flag Warning from 1100- 1900 for strong southwest winds and low relative humidity".

May 6

Onsite observations

0800 Minimal fire activity

1000 Cool - overhead winds not hitting ground

1400 Overhead winds picking up

1600 Overhead winds continuing to pick up but minimal ground contact.

NWS Products

- 0730 Presuppression Forecast...updated at 10:45am for “Red Flag Warning 11am-7pm for strong winds and low relative humidity”.
- 1500 Presuppression Forecast continued Red Flag Warning until 7pm

May 7

No observations/remarks/log sheets

NWS Products

- 0730 Presuppression Forecast...updated at 10:30am for Red Flag Warning, but Grand Canyon not included in the Warning
- 1500 Presuppression Forecast

May 8

Onsite observations

Started test fire at 1633 for proposed Widforss burn

Maximum wind 3-5 mph mainly from the south...minimum relative humidity 32%

NWS Products

0730 and 1500 Presuppression Forecast

May 9

Onsite observations

Test fire at 1020 for Widforss burn

1028 Began blacklining

Through 1030 wind 2 mph or less...minimum relative humidity 30%

1115 Request Spot Weather Forecast

1133 Operations normal

1243 Spot Weather Forecast read from Dispatch

1438 Stop ignition

NWS Products

0730 Presuppression Forecast

1215 Spot Weather Forecast

1500 Presuppression Forecast...included headline “Fire Weather Watch for Wednesday for strong winds and low relative humidity”.

May 10

Onsite observations

late morning weather...wind southwest 3-5 mph with gusts to 8 mph...minimum relative humidity 30%

1236 Spot Weather Forecast read

1310 Spot Weather Forecast remedied to include a Red Flag Warning

1636 Can't get any air tankers - too high winds. Fire activity not bad considering wind speeds

1644 Fire activity picking up

1705 Max RH 25-35%. Faxed afternoon weather to North Rim (Kim)

1805 Fire activity should be the same tomorrow as today (Kim)
10:58 From NWS Flagstaff: Expecting winds to stay high with gusts to 40 mph

NWS Products

0730 Presuppression Forecast with headline "Very Windy Today and Tomorrow"
1215 Spot Weather Forecast
1315 Spot Weather Forecast with Red Flag Warning headline
1500 Presuppression Forecast with Red Flag Warning through 7pm and Fire Weather Watch headline for Thursday (next day)

Time Line of Spot Forecasts issued by NWS Flagstaff for the Outlet Prescribed Burn

4/27/00 1115

Synopsis Summary: Another day of low RH values and near record warm high temps. An approaching trough will bring cooler weather...higher RH values...and stronger winds to the burn site by Friday and will continue through the weekend.

Today...min RH 10-16 percent
Winds becoming southwest 8 to 13 mph

Outlook for Friday...min RH 13-20 percent
Winds downslope/downvalley 3-6 mph through 1000L becoming south to southwest 10 to 20 mph with afternoon gusts to 25 mph

4/28/00 1115

Synopsis Summary: Red Flag Warning Until 1900 today....cold front will move across northern Arizona later tonight and Saturday...southwest winds of 20-30 mph with higher gusts...in addition...relative humidities will be low 10-15 percent) across the burn area.

Today...min RH 10-15 percent
Winds southwest at 20-30 mph

Tonight...max RH 65-75 percent
Winds southwest at 20-30 mph until 1900 then southwest at 5 to 15 mph

Outlook for Saturday...min RH 14-19 percent
Winds west at 15 to 25 mph

4/29/00 1135

Synopsis Summary: A weak weather disturbance will move across Arizona today and settle over New Mexico for the remainder of the weekend. This system will produce breezy west winds across the burn area this afternoon behind a weak cold front. As the system moves eastward winds will shift to the northeast on Sunday with locally breezy conditions.

Today...min RH 15-20 percent
Winds west at 15 to 25 mph

Tonight...max RH 40-50 percent
Winds west at 15 to 25 mph until 1900 then downslope/downvalley at 3 to 6 mph

Outlook for Sunday...min RH 13-18 percent
Winds northeast at 10-20 mph

Time gap of 9 days...Dispatchers report that Spot Forecast requests are made only when park managers are “actively burning.”

5/9/00 1215

Synopsis Summary: A weather disturbance will approach from the Pacific with increasing winds across the burn area. Expect breezy conditions by late this afternoon with windy conditions on Wednesday as the Pacific system moves closer to Northern Arizona. General breezy to windy conditions are expected during the daytime hours into the weekend.

Today...min RH 20-30 percent
Winds southwest at 15 to 25 mph

Tonight...max RH 40-50 percent
Winds southwest at 10-20 mph until 1900 then diminishing to southwest at 5 to 15 mph

Outlook for Wednesday...min RH 12-17 percent
Winds southwest at 20-30 mph with gusts to near 40 mph

5/10/00 1215

Synopsis Summary: A weather disturbance moving across the West will produce very windy conditions over the burn area today. Winds will begin to diminish after sunset but remain breezy overnight. Only moderate RH recovery is expected overnight. On Thursday...drier air will move across the area. With windy conditions expected to continue the fire danger will remain quite high. Breezy to windy conditions are expected during the daytime hours into the weekend.

Rest of today...min RH 15-20 percent
Winds southwest at 25 to 35 mph with gusts to 45 mph

Tonight...max RH 25-35 percent
Winds southwest at 20-30 mph until 2100 then becoming southwest at 10- 15 mph with some higher gusts

Outlook for Thursday...min RH 8-13 percent

Winds southwest 10-15 mph until 0900 then becoming southwest at 25-35 mph with higher gusts

5/10/00 115 pm UPDATED

Synopsis Summary: ...Red Flag Warning Continues Until 2100...Disturbance moving across the West will produce very windy conditions over the burn area today. Winds will begin to diminish after sunset but remain breezy overnight. Only moderate RH recovery expected overnight.

Rest of today...min RH 10-15 percent

Winds southwest at 25 to 35 mph with gusts to 45 mph

Tonight...max RH 25-35 percent

Winds southwest at 20-30 mph until 2100 then becoming southwest 10-15 mph with some higher gusts

Outlook Saturday...min RH 8-13 percent

Winds southwest 10-15 mph until 0900 then becoming southwest at 25-35 mph with higher gusts

5/10/00 1115

Synopsis Summary: A Pacific cold front stretched from Milford Utah southwest to just north of Las Vegas NV at 2300 tonight. A very tight surface pressure gradient exists between the fire site and the cold front. At the fire site...surface winds are not expected to go into a downslope down valley regime tonight due to the proximity of the surface cold front. In fact wind...southwest wind gusts over 40 mph are expected through the night. At this time the front is expected to pass the fire site between 0400 and 0700 Thursday morning. Winds should shift to the west and west northwest later in the morning. The front is very dry...in fact dew points were falling behind the front. So little significant change in max and min RH values are expected.

Rest of tonight...max RH 34-40 percent

Winds southwest 18-28 mph with gusts to near 50 mph

Thursday...min RH 8-13 percent

Winds southwest 20-35 mph with gusts to near 50 mph through 0700 becoming west 20-35 mph with higher gusts

Outlook for Thursday night...max RH 40-47 percent

Winds northwest 5-15 mph